

THE EFFECT OF PROBIOTICS AND PHYTOBIOTICS ON MEAT PROPERTIES AND QUALITY IN PIGS

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Summary. The demand of safe and qualitative meat on the market has considerably increased nowadays. The producers are eager to use natural and safe non-chemical forage supplements, which positively effect animal health, increase their productivity and improve quality of the production. The experiments were performed to study the influence of probiotics LIVEBIOS, MINGFIX and phytobiotics YUCCA, QUILLAJA on pigs growth rate and meat quality. The experimental animals in the first group were fed with mixture of grain and bean flour supplemented with probiotics - 2 kg/t flour, and in the second group with mixture of grain and bean flour supplemented with phytobiotics - 120 g/t flour, respectively. The daily weight gain of pigs given probiotics was on 18.0-20.3 % higher compared to the control group of pigs ($P>0.05$). Probiotics increased the carcass output in the experimental group of pork on 2.0–2.1 %. These preparations improved the culinary properties of pork: cooking loss decreased on 5.4 – 6.1 %, water holding capacity increased on 1.8–3.2 % ($P>0.05$), meat hardness decreased on 6.9–47.2 % ($P>0.05$). The effect of phytobiotics on experimental pigs daily weight gain and carcass output was insignificant compared to the controls ($P<0.05$). Phytobiotics YUCCA and QUILLAJA lowered meat hardness on 35.9 % and on 46.4 % compared to the control group ($P<0.05$), respectively.

Keywords: probiotics, phytobiotics, pigs, carcass, weight gain, meat quality.

PROBIOTIKŲ IR FITOBIOTIKŲ ĮTAKA KIAULIŲ MĖSINĖMS SAVYBĖMS IR MĖSOS KOKYBEI

Santrauka. Rinkoje didėjant kokybiškos ir saugios gyvulininkystės produkcijos paklausai, gamintojai stengiasi naudoti natūralius, saugius pašarinius priedus, kurie teigiamai veikia gyvulių sveikatingumą, didina gyvulių produktyvumą ir gerina produkcijos kokybę. Bandymuose tirta probiotikų LIVEBIOS, MINGFIX ir fitobiotikų YUCCA, QUILLAJA įtaka kiaulių augimo spartai ir jų mėsos kokybei. Į grūdų ir pupų miltus tiriamųjų grupių gyvuliams buvo įmaišomi probiotikai santykiu 2 kg/t miltų, 120 g/t fitobiotikų. Kiaulių, gavusių probiotikų, priešvoriai per parą atitinkamai buvo 20,3% ir 18,0% ($p>0,05$) didesni nei kontrolinės grupės kiaulių. Probiotikai 2,0 – 2,1% padidino tiriamųjų grupių kiaulių skerdenos išeigą. Šie preparatai gerina kiaulių mėsos kulinarines savybes: 5,4 – 6,1% sumažina virimo nuostolius, 1,8 – 3,2% padidina vandens rišlumą, 6,9 – 47,2% ($p>0,05$ ir $p<0,05$) sumažina mėsos kietumą. Fitobiotikai kiaulių priešvoriams per parą įtakos neturėjo. Panaudojus fitobiotikus 1,7 – 1,3% padidėja kiaulių skerdenų išeiga. Kiaulių pašarams panaudojus YUCCA, mėsos kietumas vidutiniškai buvo 35,9%, o panaudojus QUILLAJA – 46,4% ($p<0,05$) mažesnis negu kontrolinės grupės.

Raktažodžiai: probiotikai, fitobiotikai, kiaulės, skerdena, priešvoris, mėsos kokybė.

Introduction. Recently great attention to the production quality and safety has been paid as in the countries of the European Union so in Lithuania. The demand of safe and qualitative meat on the market has considerably increased nowadays, so the producers are eager to use natural and safe forage supplements, that positively effect animal health, increase their productivity and improve quality of the production.

The most modern and gaining high popularity natural forage supplements nowadays have been probiotic preparations – probiotics, prebiotics, symbiotics, phytobiotics. These preparations are considered to be biologically active preparations, created by the biotechnological methods and having antagonistic activity against the pathogenic microflora, improving the microbiological balance of the digestive system, improving animal health and quality of the production (Bakulina et al., 2001; Kavrus and Mihaljuk, 2001).

Probiotics – are forage supplements produced of the alive microorganisms, which are able positively effect the composition of the digestive microflora. Numerous data about the positive effect of probiotic preparations on the health of animals and birds, their productivity and quality

of the production have been recently obtained, they are becoming more and more popular among the farmers. It is necessary to stress that the effect of these microbiological preparations on the animal productivity in the complicated animal ecosystem has been studied insufficiently. The experiments with probiotic preparations are important as in scientific so in practical aspects. (Beauchemin et al., 2003; Peltonen et al., 2000; Klaenhammer T. R., 2000; Koloiev B., 2002). Probiotic microorganisms in the organism of a healthy animal stimulate non-specific immune response and enhance the system of the immune protection. They can also be applied in order to remove the pathogenic and conditionally pathogenic bacteria from the organism. Due to the probiotic preparations the metabolic activity of the bacterial flora in the organism is intensified, that leads to the better assimilation of the nutritive substances, and that cause higher productivity and better quality of the production. Probiotic preparations seem to be a wonderful alternative means for the treatment of the digestive infections by antibiotic preparations and other chemotherapeutic substances. The organism of the animal is able to tolerate these preparations (Boyaka et al., 2001;

Table 2. The dynamics of weight and weight gain in the fattening pigs (n = 15)

Age of the animals (days)	Weight and daily weight gain of the animals					
	Control group		LIVEBIOS		MINGFIX	
	weight, kg	daily weight gain, g	weight, kg	daily weight gain, g	weight, kg	daily weight gain, g
45	14,8 ±0,34	–	14,3 ±0,31	–	14,3 ±0,33	–
73	25,5 ±1,92	382 ±30,5	27,8 ±2,12	482 ±38,6	28,3 ±2,31	500 ±47,2
103	42,5 ±3,21	567 ±40,7	48,3 ±3,15	683 ±35,4*	49,2 ±5,55	697 ±78,3
134	61,7 ±5,72	619 ±50,3	75,0 ±7,11	861 ±70,1*	73,3 ±5,16	777 ±55,3*
164	87,5 ±6,80	860 ±66,8	100,8 ±8,10	860 ±68,8	97,5 ±6,89	807 ±49,9
188	96,5 ±8,14	354 ±31,4	111,8 ±8,84	458 ±37,1*	109,2 ±7,66	500 ±35,8*
During the whole experiment	–	556 ±43,9	–	669 ±60,5	–	656 ±53,3

* – P<0,05

Table 3. Data of the control slaughter and bone removal (n = 15)

Indicator	Group		
	Control	LIVEBIOS	MINGFIX
Carcass weight, kg	71,60 ±6,05	85,19 ±6,81	83,31 ±6,35
Carcass output, %	74,2 ±5,1	76,2 ±3,6	76,3 ±4,4
Weight of the left halve, kg	35,6 ±3,2	44,7 ±4,4	38,9 ±3,8
Ham weight, kg	11,3 ±1,05	12,7 ±1,15	11,8 ±0,98
Ham output, %	31,7 ±2,8	31,6 ±3,1	31,8 ±2,9
Tender meat output, %	89,4 ±6,8	88,2 ±5,7	89,8 ±6,3

Table 4. Meat physico-chemical properties (n = 15)

Indicator	Group		
	Control	LIVEBIOS	MINGFIX
Dry matter, %	27,18 ±0,96	27,46 ±0,88	29,86 ±1,13
pH	5,43 ±0,11	5,42 ±0,15	5,44 ±0,10
Colour, EK	57,00 ±3,61	55,50 ±3,82	57,00 ±4,78
Cooking loss, %	43,42 ±3,62	37,99 ±3,38	37,31 ±3,12
Water holding capacity	75,21 ±4,14	77,01 ±3,86	78,46 ±2,95
Hardness, kg/cm ²	2,09 ±0,16	1,97 ±0,18	1,42 ±0,26*
Ash, %	1,06 ±0,18	1,48 ±0,21	1,07 ±0,09
Fat, %	4,57 ±0,32	4,46 ±0,30	5,01 ±0,41
Protein, %	19,55 ±1,56	19,52 ±1,48	20,78 ±1,62
Protein value	4,53 ±0,36	4,55 ±0,32	4,60 ±0,37

It is evidently demonstrated by the data of this table that the most considerable effect of probiotic preparations was observed on the meat cooking loss, water holding capacity and meat hardness. In case of probiotic preparation MINGFIX meat cooking loss was 6,11 % (II experimental group), and LIVEBIOS (I experimental group) – 5,43 % lower than in the control group. Water holding capacity in the meat of the I group was by 1,8 %, and in the II group – 3,25 % higher than in the control group. Meat hardness which directly effects the quality of meat products and meat value was the best in the control group. The meat hardness of this group was by 47,18 % (P<0,05) higher than in the II experimental group, and by 6,9 % higher than in the I experimental group. Only probiotic MINGFIX positively effected the amount and value of protein.

The data of the experiments lead to the conclusion that probiotic preparations positively effect pigs' growth,

daily weight gain, carcass output and some physico-chemical properties of the meat. These preparations can also improve culinary properties.

The effect of phytobiotic preparations on the dynamics of pigs' growth is presented in the table 5. It can be concluded from these results that these preparations have no effect on the pigs' growth rate during the first month of the experiments. During the following two months of the experiments (from 76 d. to 137 d. of the age) the weight of pigs given YUCCA increased by 6,7 %, given QUILLAJA – 9,2 % more than in the control group of pigs (P>0,05). During the last month of the experiments the effect of these preparations on pigs' growth was insignificant. It can be concluded from the results of the experiments that the preparations YUCCA and QUILLAJA had no effect on pigs weight gain.

The data of control slaughter and bone removal are presented in the table 6. Obviously, these data demonstrate that phytobiotic preparations effected the carcass output. The carcass output of the pigs given preparation YUCCA was by 1,7 %, and QUILLAJA – 1,3 % higher than in the control group of pigs ($P>0,05$). The muscle area of the eye in the pigs given QUILLAJA was

by 8,4 % larger than in the control group and by 7,0 % larger than in the pigs given preparation YUCCA. The tendency of increased output of ham tender parts was observed under the effect of phytobiotic preparations.

The physico-chemical properties of the m. longissimus dorsi are presented in the table 7.

Table 5. The dynamics of weight and weight gain in the fattening pigs (n = 15)

Age of the animals (days)	Weight and daily weight gain of the animals					
	Control group		YUCCA		QUILLAJA	
	weight, kg	daily weight gain, g	weight, kg	daily weight gain, g	weight, kg	daily weight gain, g
45	12,8 ±0,6		13,0 ±0,6		12,8 ±0,5	
76	31,6 ±2,4	606 ±46,1	31,6 ±3,1	600 ±54,2	30,8 ±2,8	580 ±46,4
107	46,6 ±4,2	483 ±43,4	48,0 ±4,8	529 ±51,2	47,6 ±4,1	541 ±46,5
137	68,7 ±6,1	737 ±64,8	71,2 ±6,9	773 ±74,2	71,3 ±7,0	790 ±77,4
168	100,0 ±8,4	1009 ±84,7	100,3 ±7,8	939 ±74,2	98,3 ±8,1	871 ±70,4
During the whole experiment		709 ±59,8		710 ±63,5		695 ±60,2

Table 6. Data of the control slaughter and bone removal (n = 15)

Indicator	Group		
	Control	YUCCA	QUILLAJA
Carcass output, %	69,9 ±4,9	71,6 ±4,1	71,2 ±4,7
Ham output, %	32,4 ±2,8	31,3 ±3,2	31,8 ±2,8
Tender meat output, %	90,7 ±5,2	91,1 ±6,3	91,6 ±5,7
Muscle area of the eye, cm ²	44,9 ±3,6	45,5 ±4,8	48,7 ±4,3

Table 7. Meat physico-chemical properties (n = 15)

Indicator	Group		
	Control	YUCCA	QUILLAJA
Dry matter, %	29,3 ±1,6	29,0 ±1,9	30,7 ±2,3
pH	5,64 ±0,14	5,65 ±0,12	5,63 ±0,16
Color, EK	73,0 ±5,1	65,0 ±4,7	74,0 ±5,5
Cooking loss, %	31,3 ±3,3	38,2 ±3,7	37,3 ±3,8
Water holding capacity, %	65,47 ±4,1	65,83 ±4,9	66,22 ±4,4
Hardness, kg/cm ²	2,09 ±0,19	1,34 ±0,09*	1,12 ±0,10*
Ash, %	1,15 ±0,09	1,05 ±0,08	1,01 ±0,08
Fat, %	3,8 ±0,7	4,5 ±0,8	5,6 ±1,2
Protein value	5,25 ±0,42	4,95 ±0,36	6,27 ±0,48

* – $P<0,05$

It can be seen from the data of the table that phytobiotic preparations effected meat physico-chemical properties. When phytobiotic preparation YUCCA was used meat hardness tended to be by 35,9 %, and when QUILLAJA was used - by 46,4 % ($P<0,05$) lower than in the control group. The protein value was by 19,4 % higher in pigs given QUILLAJA than in the control group. The tendency of increased amount of fat was also observed under the effect of phytobiotics.

Meat hardness is directly related to the production quality. Subsequently, it can be concluded that YUCCA and QUILLAJA improve culinary properties of the meat, QUILLAJA also effects meat protein value.

Conclusions.

1. The daily weight gain of the pigs given probiotic preparations was respectively by 20,3 and 18,0 % ($P>0,05$) higher than in the control group. The effect of phytobiotics on the weight gain was no observed.

2. Probiotic preparations increased carcass output of the experimental pigs by 2,0 – 2,1 % ($P>0,05$). These preparations improved meat culinary properties as follows: cooking loss decreased by 5,4 – 6,1 %, water holding capacity – by 1,8 – 3,2 %, meat hardness – by 6,9 – 47,2 % ($P>0,05$ ir $P<0,05$).

3. Phytobiotic preparations increased pigs' carcass output by 1,7 – 1,3 % ($P>0,05$). Meat hardness decreased by 35,9 % under the effect of YUCCA, and by 46,4 % ($P<0,05$) under the effect of it if to compare to the control